

WHAT IS CLAIMED IS:

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1. A method for reducing a precision of an input datum having a precision portion and a loss portion, comprising:
 - a. comparing the loss portion to a preselected threshold value, f_t ;
 - b. determining a selectable bias, α , responsive to the loss portion being in a defined relation to the preselected threshold value, f_t ; and
 - c. combining the precision portion with α , creating a reduced precision datum thereby,
wherein α corresponds to a predetermined characteristic of one of α , the input datum, the reduced precision datum, and a combination thereof.
2. The method of claim 1, wherein determining the selectable bias further comprises one of:
 - a. assigning a first value to α , responsive to the loss portion being substantially equal to f_t ;
 - b. assigning a second value to α , responsive to the loss portion being less than f_t ; and
 - c. assigning a third value to α , responsive to the loss portion being greater than f_t .
3. The method of claim 1, further comprising determining the selectable bias responsive to a predetermined characteristic

of a plurality of input data relative to a corresponding plurality of reduced precision data.

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4. The method of claim 1, further comprising determining the selectable bias responsive to a predetermined characteristic attributable to reducing the precision of the input datum.

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5. The method of claim 1, further comprising determining the selectable bias responsive to the predetermined characteristic of the selectable bias, the predetermined characteristic being the mean value of a plurality of selectable bias values.

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6. The method of claim 2, further comprising determining the selectable bias responsive to a predetermined characteristic of a plurality of input data relative to a corresponding plurality of reduced precision data, and the predetermined characteristic being attributable to reducing the precision.

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7. The method of claim 6, wherein the predetermined characteristic is a predetermined mean error value.

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8. The method of claim 2, further comprising determining the selectable bias responsive to a predetermined characteristic

of one of input data, a corresponding reduced precision data, and a combination thereof.

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9. The method of claim 8, wherein the predetermined characteristic comprises a predetermined statistical value.

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10. The method of claim 4, wherein the predetermined characteristic comprises a predetermined mean error value of the plurality of reduced precision data relative to a corresponding plurality of input data.

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11. The method of claim 9, wherein the predetermined statistical value comprises the mean value of the reduced precision data relative to a corresponding plurality of finite-precision fixed point input data.

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12. The method of claim 2, further comprising assigning a fourth value to α , responsive to α being substantially equal to f_t , the fourth value being in a predefined relationship with the first value.

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13. The method of claim 12, further comprising determining the selectable bias responsive to a predetermined characteristic of input data relative to corresponding reduced precision

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5 data, and the predetermined characteristic being a preselected mean error value associated therewith.

10 14. The method of claim 12, wherein:

15 a. the f_t is approximately equal to 0.5_{10} ;

20 b. the first value is 1 when the value of the loss portion substantially equals about 0.5_{10} , the input datum is a negative-valued datum, with the first value being added to the precision portion;

25 c. the second value is zero when value of the loss portion is less than about 0.5_{10} ;

30 d. the third value is 1 when the value of the loss portion is greater than about 0.5_{10} , with the third value being added to the precision portion;

35 e. the fourth value is 0 when the loss portion substantially equals about 0.5_{10} , and the input datum is a positive-valued datum; and

f. the preselected mean error value relative to the input datum and the reduced precision datum is minimized.

30 15. The method of claim 11, wherein:

35 a. f_t is substantially equal to 0.5_{10} ;

b. the first value is a current first value being selected to be one of '1' and '0' when the value of

5 the loss portion substantially equals about 0.5_{10} , in
a predefined relationship to a previous first value;

10 *SAC 02*

- c. the second value is zero when the loss portion is less
than about 0.5_{10} ; and
- d. the third value is 1 when the loss portion is greater
than about 0.5_{10} , with the third value is added to the
value of the precision portion.

15 16. The method of claim 14, wherein the predefined relationship
is an alternating relationship.

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17. The method of claim 16, wherein the alternating relationship
is a toggle relationship with the current first value being
zero if the previous first value was 1, and the current
first value being 1 if the previous first value was zero,
and wherein the preselected mean error value is minimized
responsive to the alternating relationship.

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18. The method of claim 15, wherein the alternating relationship
includes a selectable number of 1's being interleaved with
a selectable number of zeros, the mean value of the reduced
precision data being responsive to the alternating
relationship.

19. The method of claim 2, wherein each of the input datum and
5 the reduced precision datum are represented by two's
complement fixed point values.

10 20. The method of claim 16, wherein the alternating relationship
includes a selected pseudorandom sequence of data bits.

20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 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5230 5235 5240 5245 5250 5255 5260 5265 5270 5275 5280 5285 5290 5295 5300 5305 5310 5315 5320 5325 5330 5335 5340 5345 5350 5355 5360 5365 5370 5375 5380 5385 5390 5395 5400 5405 5410 5415 5420 5425 5430 5435 5440 5445 5450 5455 5460 5465 5470 5475 5480 5485 5490 5495 5500 5505 5510 5515 5520 5525 5530 5535 5540 5545 5550 5555 5560 5565 5570 5575 5580 5585 5590 5595 5600 5605 5610 5615 5620 5625 5630 5635 5640 5645 5650 5655 5660 5665 5670 5675 5680 5685 5690 5695 5700 5705 5710 5715 5720 5725 5730 5735 5740 5745 5750 5755 5760 5765 5770 5775 5780 5785 5790 5795 5800 5805 5810 5815 5820 5825 5830 5835 5840 5845 5850 5855 5860 5865 5870 5875 5880 5885 5890 5895 5900 5905 5910 5915 5920 5925 5930 5935 5940 5945 5950 5955 5960 5965 5970 5975 5980 5985 5990 5995 6000 6005 6010 6015 6020 6025 6030 6035 6040 6045 6050 6055 6060 6065 6070 6075 6080 6085 6090 6095 6100 6105 6110 6115 6120 6125 6130 6135 6140 6145 6150 6155 6160 6165 6170 6175 6180 6185 6190 6195 6200 6205 6210 6215 6220 6225 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d. eliminating the loss portion of \mathbf{x} , producing \mathbf{x} thereby.

22. The method of claim 21, wherein selectable bias α is representative of a predetermined characteristic of one of
10 \mathbf{x} , \mathbf{x} , α , and a combination thereof.

23. The method of claim 22, wherein the preselected threshold
15 is substantially equivalent to 0.5_{10} .

24. The method of claim 23, wherein the predetermined
20 characteristic comprises a preselected mean error value of \mathbf{x} relative to \mathbf{x} .

25. The method of claim 24, wherein the preselected mean error
25 value, $E(e)$, is substantially defined by the equation:

$$E(e) = 2^{-a}(E(\alpha) - \beta_2),$$

where $E(\alpha)$ is a mean value of selectable bias α .

26. The method of claim 25 wherein the mean value of the
30 selectable bias is substantially within the range of

$$0.0 \leq E(\alpha) \leq 1.0$$

27. The method of claim 26, wherein the mean value of the
35 selectable bias, $E(\alpha)$, is approximately equal to

5 preselected mean error value, $E(e)$, and $E(\alpha)$ is
approximately zero.

10 28. The method of claim 27, wherein the predetermined
characteristic further comprises a preselected error
variance value, σ_e^2 , substantially defined by the equation:

$$\sigma_e^2 = \frac{2^{-2b} + 2^{-(2a-1)}}{12}$$

15 29. The method of claim 28, wherein the rounding digit is
selected from a alternating sequence of digits in the pair
of digits <0,1>.

20 30. The method of claim 28, wherein the rounding digit is
selected from a pseudorandom sequence of binary digits.

25 31. A method for rounding a first two's complement fixed point
datum, x , having an integer part of n bits, a fractional
part of a bits the integer part, and sign bit, s_i , to a
30 second two's complement fixed point datum, \hat{x} , having a
fractional part of b bits following the radix point, where
35 a and b are representative of the respective precisions of
 x and \hat{x} , and where $a > b$, comprising:

5 a. evaluating the fractional part of X and defining y as the most significant bit (MSB) of the a bits;

b. if the first bit following the radix point of X is equal to a 1 bit trailed by $(a-1)$ zero bits, then defining \hat{X} according to the equation:

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$$\hat{X} = n + s_i$$

15 and

c. otherwise, defining \hat{X} according to the equation:

$$\hat{X} = n + y$$

20 32. The method of claim 31, wherein the occurrence of positive numbers and negative numbers in a plurality of the datum, X , is substantially equiprobable.

25 33. A method for rounding signal values, comprising:

a. detecting a predetermined state value wherein rounding is desired; and

b. rounding the state value according to one of

30 i. an alternating round-up/round-down method and

ii. a sign addition round-up/round-down method.

35 34. An arithmetic device, comprising a bias generator producing a selectable bias α , responsive to a predetermined signal characteristic, the device receiving an input signal and

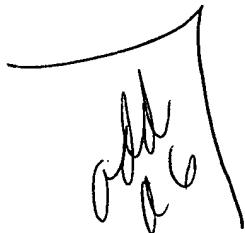
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coupling the selectable bias α thereto.

5 35. The arithmetic device of claim 34, further comprising
a combiner coupled to the bias generator, the combiner receiving
and combining the input signal and the selectable bias α , and
10 producing an output signal.

36. The arithmetic device of claim 34 further comprising
wherein the bias generator further comprises a comparator for
15 comparing the input signal to a preselected threshold value, the
comparator urging the bias generator to produce the selectable
bias α responsive to the preselected threshold value.

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